The following discussion is primarily based on the geotechnical investigation of the project site conducted by Twining Laboratories in August 2004. A copy of the geotechnical report is included in Appendix F of this EIR.

3.6.1 ENVIRONMENTAL SETTING

REGIONAL GEOLOGY

The project site is located at the narrow part of south Santa Clara Valley, which is underlain by thick accumulations of alluvial sediments. The valley is flanked by the Santa Cruz Mountains to the west and the Diablo Range to the east. The underlying bedrock consists mainly of Franciscan Complex or the Santa Clara Formation, although smaller deposits of other rock units are found in the area. The predominant material is the Franciscan Complex, which includes various forms of sandstone, shale, greenstone and chert. These rocks are part of the northwest-trending belt of material that lies along the east side of the San Andreas Fault System. In certain areas this formation is intruded with large masses of serpentinite, as occurs along the hillsides on the east side of the Coyote Valley just north of the project site. The Santa Clara Formation, which underlies the adjacent ridge between Anderson Reservoir and the valley floor, consists of poorly consolidated sedimentary rocks such as sandstone, siltstone and claystone, and volcanic rocks such as basalt, tuff, scoria and obsidian.

SOILS

According to information provided by the Natural Resources Conservation Service (NRCS), the soils covering most of the project site consist of Arbuckle gravelly loam (ArA) with a small area of San Ysidro loam (SdA) located in the southwestern corner of the site near Cochrane Road and U.S. Highway 101.

The Arbuckle gravelly loam has a moderate shrink-swell potential, moderate subsoil permeability, and low erosion potential. It has a land capability classification of Class II for agriculture. See Section *3.2. Agricultural Resources* for further discussion.

San Ysidro loam is characterized as having a high shrink-swell potential, very slow permeability (due to claypan subsoil), and low erosion potential. It has a land capability classification of Class III for agriculture. See Section *3.2. Agricultural Resources* for further discussion or soil characteristics.

The geotechnical investigation conducted by Twining Laboratories included a detailed characterization of on-site soils. In general, the soils were found to consist of hard and dense silts, sands, and clays, which included gravel and cobbles below a depth of about three feet. The near surface soils exhibited high compressibility and high collapse potential, high shear strength, and poor to fair pavement support characteristics. The near surface sandy clay to sandy silt soils exhibited a very low to low potential for expansion. The geotechnical

investigation found that the soils exhibit a mild corrosion potential to buried metal objects. In addition, it was reported by one of the property owners, during preparation of the geotechnical investigation, that fill soils had been imported to the site as part of a nearby pipeline project; although, the fill material was not identified during the course of Twining's investigation.

GROUNDWATER CONDITIONS

No groundwater was encountered to depths of over 50 feet in any of the soil borings for the geotechnical investigation. A review of available data sources by Twining Laboratories indicated that historically high groundwater depth is about 40 feet below the ground surface at the site. However, water tables are subject to fluctuation over time, depending on seasonal precipitation, irrigation, land use, climatic conditions and other factors.

FAULTS AND SEISMICITY

The project site is located in a seismically active region, with numerous active and potentially active faults associated with the San Andreas Fault System which runs through the area. The most significant local faults are the Calaveras Fault, which is a major branch of the San Andreas located about three miles east of the project site, and the Sargent Fault located about eight miles west of the site. There are also three smaller faults, all of which appear to be connected to the Calaveras Fault, including the Silver Creek Fault, the Coyote Creek Thrust Fault, and the Range Front Thrust Fault, which are all located from one half mile to one mile east of the site.

SEISMIC HAZARDS

The potential seismic hazards of concern to the project include groundshaking, ground rupture, liquefaction, and seismic settlement. These are discussed in turn below.

Ground Shaking

The two active faults within ten miles of the site (the Calaveras and Sargent faults) would result in the greatest potential groundshaking at the project site. Based on a magnitude 7.9 earthquake, the peak horizontal ground acceleration with a ten percent probability of occurring in 50 years was determined to be 0.83g (g is defined as the force of gravity). The California Building Code (CBC) specifies design criteria applicable to new construction based on predicted ground shaking.

Ground Rupture

Damage resulting from fault rupture occurs only where structures are located astride fault traces that move during earthquakes. The project site is not located in a state-designated fault

rupture zone under the Alquist-Priolo Earthquake Fault Zoning Act. Therefore, the potential for surface rupture at the site is considered low.

Liquefaction

Liquefaction is the phenomenon in which a saturated, cohesionless soil loses structural strength during an earthquake as a result of excessive pore water pressure induced by shearing strains, which essentially transforms the soil to a liquid state resulting in ground failure or surface deformation. Conditions required for liquefaction include fine, well-sorted, loose sandy soil, high groundwater, higher intensity earthquakes, and particularly long duration of ground shaking. Ground accelerations of at least 0.10g and ground shaking durations of at least 30 seconds are needed to initiate liquefaction.

The northern portion of the site (approximately one-fourth of the site area) lies within a Seismic Hazard Zone for liquefaction hazards as designated by the State of California (Seismic Hazard Mapping Act of 1990). However, based on Twining's laboratory analysis of soil samples taken from the site, the risk of liquefaction throughout the project site was found to be low. The soils at the project site are very dense and hard, and groundwater is at least 40 feet below the ground surface. These subsurface conditions are not indicative of liquefaction potential. However, due to the potential variability of subsurface soils and depth to groundwater across the site, Twining Laboratories recommended that the proposed structures be evaluated for liquefaction potential on a case-by-case basis as part of future design-level geotechnical engineering investigations.

Seismic Settlement

Seismic settlement can occur in both saturated and unsaturated granular soils, and results from the rearrangement of granular soils during cyclic loading induced by ground shaking, resulting in volume reduction and surface deformation. The soils at the project site are susceptible to seismic settlements of one quarter of an inch. However, combined seismic and static settlements of up to 1.25 inches are anticipated.

Landslides

Due to the relatively level topography of the site, the potential for landslides at the project site is considered low. The project site is not located within a Seismic Hazard Zone for seismically-induced landslides as designated under the state Seismic Hazard Mapping Act of 1990.

Lateral Spreading or Slumping

Lateral spreading is the lateral displacement of flat-lying alluvial material toward an open area or a free face such as a steep bank of a stream channel. It can occur with seismic

ground shaking on slopes with saturated soils. Since the project is virtually flat, the potential for lateral spreading is considered low.

MINERAL RESOURCES

There are no known sources of mineral resources on the project site or in the vicinity. In the past, extraction of sand and gravel occurred along the reach of Coyote Creek between Morgan Hill and San José, with the materials primarily used in the construction of U.S. Highway 101 through the Coyote Valley in the early 1980s. This mining activity ceased operation in 1995, and the quarry has since been reclaimed and incorporated into the County's Coyote Creek Parkway.

3.6.2 REGULATORY SETTING

GENERAL PLAN

The following *City of Morgan Hill General Plan* goal and policy related to geologic hazards are relevant to the proposed project:

Public Health and Safety

Goal 1 Reduction of potential harm to persons or property from geologic/seismic hazards.

Policy 1g New development should avoid hazardous or sensitive areas, and should occur only where it can be built without risking health and safety. New habitable structures should not be allowed in areas of highest hazard such as floodways, active landslides, active fault traces, and airport safety zones. In areas of less risk, development should be limited and designed to reduce risks to an acceptable level.

3.6.3 IMPACTS AND MITIGATION MEASURES

STANDARDS OF SIGNIFICANCE

The following thresholds for measuring a project's environmental impacts are based on CEQA Guidelines and previous standards used by the City. For purposes of this EIR, the geologic and soils impacts associated with the project are considered to be significant if the following would result from implementation of the proposed project:

- Expose people or structures to potential substantial adverse effects including the risk of loss, injury, or death involving:

i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault;

ii) Strong seismic ground shaking;

iii) Seismic-related ground failure, including liquefaction;

iv) Landslides.

- Result in substantial soil erosion or the loss of topsoil.
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.
- Be located on expansive soil, creating substantial risks to life or property.
- Expose people or property to major geologic hazards that cannot be mitigated through the use of standard engineering design and seismic safety design techniques.

METHODOLOGY

The following impact evaluation is largely based on the findings and recommendations contained in the preliminary geotechnical report by Twining Laboratories, which is included in Appendix F of this EIR. The geotechnical investigation included soil borings at 12 locations throughout the site, focusing on proposed building locations. The soils were tested for a range of engineering properties to determine their suitability for the proposed development. The geotechnical report includes recommendations for grading and special treatment of soils to overcome identified deficiencies. The findings and recommendations of the geotechnical investigation form the basis of the following discussion of impacts and mitigations.

PROJECT IMPACTS AND MITIGATION MEASURES

Seismic Ground Shaking

Impact 3.6-1 Strong ground shaking occurring on the site during a major earthquake event could cause severe damage to project buildings and structures. This is considered a **significant impact**.

Historically, major earthquakes centered on area faults, have resulted in moderate to severe ground shaking at the project site. It is expected that a major earthquake will result in severe ground shaking at the site during the life of the project.

Ground shaking will cause dynamic loading, which will result in stress to buildings and structures. However, structures designed and built in accordance with the applicable criteria of the 2001 California Building Code, as required by the City of Morgan Hill, should respond well except during the most severe potential ground shaking.

According to Twining Laboratories, from a geotechnical engineering standpoint, the project site is considered suitable for development provided that the recommendations contained within the geotechnical evaluation are implemented in the design and construction of the proposed project. Implementation of the following mitigation measure, which would require that proposed project is designed in accordance with the requirements of the current edition of the California Building Code, and recommendations contained in the geotechnical report approved by the City of Morgan Hill, would ensure that potential impacts to residents and structures from seismic ground shaking would be reduced to a **less than significant level.**

Mitigation Measure

MM 3.6-1 Structural damage to buildings resulting from ground shaking shall be minimized by following the requirements of the California Building Code, and implementing the recommendations of the project geotechnical engineer.

Structures at the site shall be designed and constructed to withstand anticipated earthquake loads. A structural engineer, experienced in the design and construction of commercial structures within areas of high seismicity, shall be retained by the project applicant to provide design and construction recommendations, as required by the City of Morgan Hill. Any such recommendations shall be made in conjunction with Final Map submittals.

Liquefaction

Impact 3.6-2 There is a low, but not necessarily insignificant, potential for liquefaction at the project site, which could result in differential settlements and damage to project structures and improvements. This is considered a **potentially significant impact.**

The northern portion of the project site (approximately one-fourth of the site area) lies within a Seismic Hazard Zone for liquefaction hazards as designated by the State of California

(Seismic Hazard Mapping Act of 1990). However, based on Twining's laboratory analysis of soil samples taken from the site, the risk of liquefaction throughout the project site was found to be low. Soils at the project site are very dense and hard, and groundwater is at least 40 feet below the ground surface. These subsurface conditions are not indicative of liquefaction potential. However, due to the potential variability of subsurface soils and depth to groundwater across the site, there is some potential for liquefaction at the site. This is considered a significant impact. Implementation of the following mitigation measure would reduce this impact to a **less than significant level**.

Mitigation Measure

MM 3.6-2 All proposed structures at the project site shall be evaluated for liquefaction potential on a case-by-case basis as part of subsequent design-level geotechnical engineering investigations. If there is determined to be a potential for liquefaction, mitigation will be accomplished through compliance with the recommendations contained in the design-level geotechnical engineering reports with recommendations included as specifications in the construction contract documents.

Seismic Settlement

Impact 3.6-3 There is a potential for seismically-induced ground settlements at the site, which could result in damage to project foundations and structures. This is considered a **potentially significant impact.**

The geotechnical investigation determined that maximum seismic settlements of one quarter of an inch could be expected at the project site. However, combined seismic and static settlements of up to 1.25 inches are anticipated. These settlements would exceed the tolerances for conventional shallow spread foundations and slabs on grade planned for the project. This is considered a significant impact. Implementation of the following mitigation measure would reduce this impact to a **less than significant level**.

Mitigation Measure

MM 3.6-3 Near-surface soils beneath buildings, exterior slabs, and pavements shall be overexcavated and recompacted, in accordance with the specifications to be recommended by the project geotechnical engineer.

The depth of required overexcavation will vary depending on whether the improvements to be supported consist of building pads or foundations, exterior slabs on grade, or pavement areas.

Soil Compressibility and Collapse Potential

Impact 3.6-4 Soils present on the site exhibit high compressibility and high collapse potential, which could result in damage to structures. This considered a **potentially significant impact.**

Testing conducted by Twining Labs indicated that due to the compressible nature of the near surface soils, they would not provide adequate support for the proposed improvements in their present condition. Implementation of the following mitigation measure would reduce this impact to a **less than significant level**.

Mitigation Measure

MM 3.6-4 The effects of soil compressibility and collapse potential shall be mitigated through over-excavation and compaction of soil beneath proposed structures, in accordance with the specifications to be recommended by the project geotechnical engineer.

The depth of required over-excavation will vary depending on whether the improvements to be supported consist of building pads or foundations, exterior slabs on grade, or pavement areas.

Implementation of the above mitigation measures would reduce impacts to soil compressibility and collapse potential to a **less than significant** level.

Expansive Soils

Impact 3.6-5 There is a low, but not necessarily insignificant, potential for soils expansion at the site, which could result in differential subgrade movements and cracking of foundations. This is considered a **potentially significant impact.**

Expansive soils are subject to shrinking and swelling during seasonal wetting and drying cycles. The resulting changes in soil volume can cause cracking of foundations and floor slabs. According to the *Soil Survey of Eastern Santa Clara Area, California* (NRCS 1974), the Arbuckle soils underlying most of the project site have a low shrink-swell potential and the San Ysidro soils in the southwest corner of the site have a high shrink-swell potential. Twining's soil borings indicated that expansion potential is variable, and localized pockets of expansive soils may be present on the site. **Mitigation Measure MM 3.6-1** would require that the proposed project be designed to comply with the most recent State California Uniform Building Code and would incorporate recommendations from the geotechnical investigation into the building design. In addition, implementation of the following

mitigation measure would reduce the effects of expansive soils at the project site to a **less than significant level.**

Mitigation Measure

MM 3.6-5 All final design specifications to be recommended by the project geotechnical engineer shall be incorporated into the project design, including placement of non-expansive engineered fill below foundation slabs, and other measures to prevent saturation of soils beneath structures to be specified by the geotechnical report.

The geotechnical report contains preliminary recommendations for keeping runoff away from foundations and floor slabs, including directing roof drainage directly into the storm drain system; providing positive drainage away from buildings; planting landscaping at least 10 feet from structures; minimizing landscape irrigation requirements through selection of plants with low water requirements; irrigation with low-volume drip, bubblers or mist type emitters, among other things.

Soil Corrosivity

Impact 3.6-6 The project soils are mildly corrosive to buried metal objects, and could result in damage to buried utilities. This is considered a **potentially significant impact**.

The preliminary geotechnical investigation found the site soils to be mildly corrosive to ferrous alloy pipes, although the soils were found not to be corrosive to concrete. Implementation of the following mitigation measure would reduce this potentially significant impact to a **less than significant level.**

Mitigation Measure

MM 3.6-6 The proposed project shall utilize corrosion-resistant materials in construction. Buried metal objects would be protected by selecting materials resistant to mild corrosion per manufacturers' specifications.

Stormwater Basin Bank Instability

Impact 3.6-7 There is a potential for bank instability along the banks of the proposed detention basins for the project. This is considered a **potentially significant impact.**

The potential for bank instability would be investigated as part of a design-level geotechnical study for the project. The study could result in a recommended establishment of a setback zone from the basin.

The project site plan indicates that the nearest buildings in the proposed project would be located approximately 60 feet and 75 feet from the basins, which should represent adequate setback distances. Implementation of the following mitigation measure would reduce this significant impact to a **less than significant level**.

Mitigation Measure

MM 3.6-7 Design-level geotechnical studies shall investigate the potential of bank instability at the proposed stormwater detention basins and recommend appropriate setbacks, if warranted. Final design recommendations to be recommended by the project geotechnical engineer shall be included as specifications in the construction contract documents.

Implementation of the above mitigation measure would reduce impacts to storm basin bank instability to a **less than significant** level.

[Note: Erosion and siltation impacts are addressed in Section *3.8. Surface Water Hydrology and Water Quality*.]

CUMULATIVE IMPACTS AND MITIGATION MEASURES

Cumulative Impacts from Geologic Hazards

The proposed project and project impacts will not combine with any other factors or projects and, thus, is not significant due to the localized, site-specific nature of geotechnical and seismic impacts. No significant cumulative impacts are predicted relative to geology or geologic hazards. Cumulative development would result in **no cumulative impacts**.

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